



# **Inventory & Monitoring Program**

## **Pacific Island Network Monitoring Plan**

### **Supporting Documents: Kalaupapa National Historical Park Resource Overview**

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#### **Pacific Island Network (PACN)**

##### *Territory of Guam*

War in the Pacific National Historical Park (WAPA)

##### *Commonwealth of the Northern Mariana Islands*

American Memorial Park, Saipan (AMME)

##### *Territory of American Samoa*

National Park of American Samoa (NPSA)

##### *State of Hawaii*

USS Arizona Memorial, Oahu (USAR)

Kalaupapa National Historical Park, Molokai (KALA)

Haleakala National Park, Maui (HALE)

Ala Kahakai National Historic Trail, Hawaii (ALKA)

Puukohola Heiau National Historic Site, Hawaii (PUHE)

Kaloko-Honokohau National Historical Park, Hawaii (KAHO)

Puuhonua o Honaunau National Historical Park, Hawaii (PUHO)

Hawaii Volcanoes National Park, Hawaii (HAVO)

<http://science.nature.nps.gov/im/units/pacn/monitoring/plan/>

## **EXECUTIVE SUMMARY & INTRODUCTION**

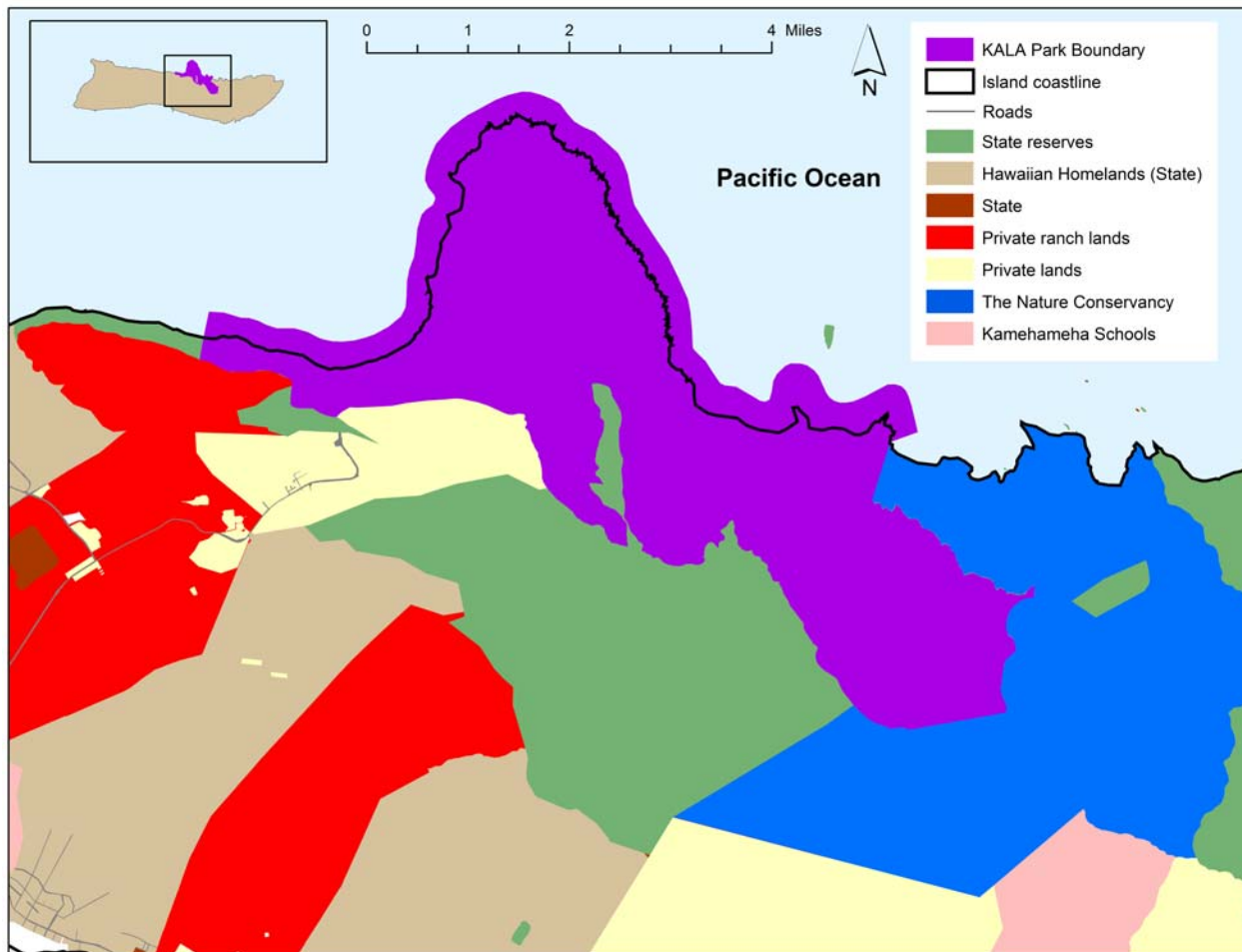
### **Enabling Legislation**

Kalaupapa National Historical Park (KALA) was created December 22, 1980 in order to provide for the preservation of the unique nationally and internationally significant cultural, historic, educational, and scenic resources of Kalaupapa Peninsula. The park preserves and interprets the Kalaupapa settlement, community and its character, the current lifestyle of the patients, and maintains important historic structures, traditional Hawaiian sites, cultural values, and natural features. Limited visitation by the general public is allowed. Preservation and interpretation of the settlement is to be managed and performed by patients and Native Hawaiians to the extent practical. The park contains the Kalaupapa Leprosy Settlement, is listed on the National Register of Historic Places as a national historic landmark. A section of the park is included within the North Shore Cliffs National Natural Landmark. The Puu Alii plateau is designated a state Natural Area Reserve (NAR), and is also included within the authorized boundary of the park. The Molokai Lighthouse is listed separately on the national register.

To find enabling legislation documents on-line follow the “Policy & Legislation” link from the Pacific Island Network website ([www1.nature.nps.gov/im/units/pacn](http://www1.nature.nps.gov/im/units/pacn)).

### **Geographic Setting**

Located on the island of Molokai, Kalaupapa National Historical Park (KALA) is roughly 10,800 acres and encompasses the peninsula and settlement of the same name, adjacent cliffs and valleys, and submerged lands (see map below). Visitation averages approximately 76,000 people per year (only guests of residents may stay overnight or leave the Kalaupapa settlement boundaries when accompanied by their sponsor). On the peninsula, median annual rainfall ranges from less than 25 inches up to 75 inches. The Puu Alii – Ohialele Plateau and Waikolu Valley are the wettest spots within the park, and has a perennial fresh water stream. The community of Kalaupapa, on the leeward side of the Kalaupapa Peninsula, is still home for many surviving Hansen's disease patients. Access to the park is by boat, air, or down a steep trail. The park's boundary extends for a quarter mile offshore and includes 2,000 acres of ocean, two small islands, and shorelines. Nearly all of the land within the 10,700+ acre authorized boundary remains in non-federal ownership, although it is managed by the National Park Service through several cooperative agreements. Land owners include the Department of Hawaiian Home Lands, and the State of Hawai'i departments of Health, Transportation, and Land & Natural Resources. The US Coast Guard owns and operates the Molokai Lighthouse. Surrounding land owners include the State of Hawaii, The Nature Conservancy of Hawaii and Other private land owners. Surrounding land use includes conservation land and ranch land.



### **Significant Natural and Cultural Resources**

The park encompasses the north shore cliffs, narrow valleys, a volcanic crater, rain forest, lava tubes and caves and off-shore islands and waters. Within the park, the rim of a volcano remnant rises over 450 feet, forming Kauhako Crater with a crater lake at the bottom more than 800 feet deep. Nearly 20 federally-listed threatened and endangered species of plants and animals have been identified within the park. Introduced animals remain, including axis deer (*Axis axis*), feral goats (*Capra hircus*), feral pigs (*Sus scrofa*), mongoose (*Herpestes auropunctatus*), rats (*Rattus sp*), cats (*Felis catus*) and dogs (*Canus familiaris*). The lake at the crater bottom contains an endemic sub-species of shrimp (*Paleomon debil*). Lava tubes and caves on the peninsula contain endemic invertebrate species and as yet incompletely inventoried flora and fauna. Waikolu Valley contains the park's sole perennial stream. The stream contains all five native diadromous fish species, native snails, and shrimp. Surface and groundwater withdrawn from Waikolu is the source of most water for the entire western half of Molokai.

The parks most significant cultural resource are the Hansen's Disease patients, who continue to live in Kalaupapa. Their presence, knowledge, and background make this park unique in the national park system. There are 400 homes, churches, monuments, and associated structures, which interpret the history of the settlements. Five of these are a tangible reminder of life at Kalaupapa. Two of the most important structures are the two churches at the site of the original settlement in Kalawao. One of the churches was remodeled by the internationally famous Belgian priest, Father Damien de Veuster. The historic information and objects collected by both patients and the Park Service provide knowledge and insight into the lives of the residents of Kalaupapa. These objects help to tell the story of the settlements. Archeological remains including the stone ruins of ancient temple sites and terrace walls provide clues to the history of the native Hawaiians who lived on the peninsula and in the valleys before the area became a Hansen's Disease settlement.

### **Resource Management Priorities**

Resource management priorities include preservation of native species and control of non-native species. This is performed through cooperative management with adjacent land owners and community groups as a major strategy for resource protection

Cultural resource priorities include stabilization, preservation, protection, and interpretation of archeological sites while allowing resident patients to live on the peninsula

## NATURAL RESOURCES

### Focal Ecosystems and Processes

- Coastal strand vegetation communities that contain rare and endangered plants
- Loulu palm (*Pritchardia*) coastal forest
- Remnant lowland mesic forest
- Rare native vegetation on cliff faces
- Lowland rain forest
- Upper-elevation rain forests at Waikolu and Puu Alii,
- Diverse dry land native forest
- Rare insect species (incl. pollinators)
- Protected offshore islets that support unusual vegetation, as well as endangered plant species
- Endangered monk seal pup rearing sites
- Mass wasting occurs along the massive cliffs of Molokai 's north shore.
- Kauhako Crater lake. Lakes are extremely rare in Hawaii, and most are found at high elevations. Preliminary surveys of the lake fauna have confirmed its unique characteristics including a new species of copepod. In 1999 a genetically isolated population of shrimp was found there.
- Waikolu stream. Although partially diverted for human use, Waikolu host to all five native diadromous fish species as well as a large population of the relatively uncommon native Hawaiian stream snail, hihiwai (*Neritina granosa*).

***Threatened and Endangered species:*** Four endangered plant species have been reported from the peninsula (including Okala Islet), and others may be found on unsurveyed cliffs in or near the Park. There are at least eight plant species of concern found within the park in Kauhako Crater, offshore islets, coastal strand, and other sites. When including the Natural Area Reserve the Park total of rare plant species increases to at least 20 endangered and threatened species , 4 candidate endangered, and more than 25 species of concern.

- *Scaevola coriacea* and *Brighamia rockii*, and four species of concern are found on off shore islets.
- Carter's panicgrass, (*Panicum fauriei* var. *carteri*) is found in the coastal spray zone.
- *Cyanea procera* , and *Melicope reflexa*, all federally endangered plants, are found in Waikolu Valley.
- A large number of endangered species and species of concern are known from Puu Alii Natural Area Reserve.
- The Hawaiian monk seal, a listed endangered species, uses beaches in the park boundary to pup; the park contains the largest population of seals outside the Northwest Hawaiian Islands.
- Green sea turtles (federally listed as threatened) occur in the park where they forage and nest when beach conditions are suitable.

- Endangered damselfly species, *Megalagrion pacificum* and *M. xanthomelas*. Are found in Waikolu Stream. These species are formerly widespread lowland species that have been extirpated from several islands.
- Three rare bee species are found at the nearby Mo'omomi Preserve and probably inhabit coastal areas of the park.
- Kakawaihe (*Paroreomyza flammea*) and Olomao (*Myadestes lanaiensis*) both thought to be extinct were seen at Puu Alii. Iiwi (*Vestiaria coccinea*) is rarely seen on Molokai and has been sighted at Puu Alii.

### **Threats & Stressors**

- The vegetation of KALA is threatened by feral goats, pigs, and axis deer. The latter species appears to be the most damaging to the Park's resources, especially in the dry forest. Pigs cause extensive damage on the Puu Alii plateau and in Waikolu valley. Detrimental effects include both plant community destruction through digging and herbivory, and subsequent erosion due to loose soil and impacted vegetation. Erosion reduces soil quality and affects stream resources, increasing sedimentation and affecting nutrient load.
- Invasive species (rats, invertebrates, fish) also threaten park resources; rats which consume, native snails, plant seeds, and bird eggs and mongooses which eat bird eggs, chicks, and adults. Human impacts on offshore islets, even at low levels, may affect rare native plants, especially through introduction of alien species currently absent from the islets. Alien species (fish, molluscs, and crustaceans) could heavily impact native invertebrates in Kauhako Crater lake if introduced, as has been documented in Hawaiian anchialine pools.
- Climate change can affect vegetation by raising cloud levels, reducing precipitation and changing upland forest character, thereby affecting stream flow. Ground-nesting birds and monk seals may also be threatened by climate change due to rising sea levels and increasing severe weather events.
- Water diversion for agriculture and drinking water is a major stressor on stream habitat quality in Waikolu, reducing flow levels and increasing water temperature. This can have a cascading effect on invertebrates, which rely on intact native vegetation and streams with natural flow regimes and temperatures. In addition, invertebrates are threatened by invasive vertebrates and invertebrates, including fish, ants, yellowjackets (*Vespula pensylvanica*), snails, and the Tahitian prawn (*Macrobrachium lar*).
- Locally generated and teleseismic (from Alaska) tsunamis are potential threats to both biotic and geological resources.
- Toxic and nutrient pollutants from village areas can cause point source pollution in remote areas.
- Hurricanes can cause extensive damage on the peninsula.

### **Water Quality Designations**

Hawaii's surface and marine waters are classified according to their use by the Hawaii Department of Health under Hawaii Administrative Rules, Title 11, Ch. 54, 2000. The official KALA boundary extends one quarter mile offshore. Kauhako lake and offshore coastal waters are considered unique and pristine. There are no impaired waters on the peninsula. Inland waters are currently classified as 1a (in natural state as nearly as possible, with an absolute minimum of pollution from any human caused source). Marine waters are classified as AA (in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions. Marine bottom ecosystems are classified as I (in their natural pristine state with an absolute minimum of pollution from any human-induced source).

### **CULTURAL ISSUES**

- Destruction of archeological sites by alien vegetation and ungulates
- Destruction of archeological sites by invasive plants
- Hunting by community members
- Harvesting of marine resources

A large number of archeological sites are negatively impacted by encroaching vegetation. Trees and shrubs deform rock walls and graves and feral ungulates displace rock walls while making trails. Treatment of vegetation on all archeological sites is difficult due to the large area the park and the extent of the infestation of alien plants. Harvesting of marine resources is limited to residents yet poaching does occur. Resident and staff subsistence hunting on the peninsula makes possibility feral ungulate reduction difficult.

### **MANAGEMENT ISSUES**

#### **Park Management**

The Act authorizing Kalaupapa National Historical Park (Public Law 96-565 enacted December 22, 1980) set forth the following as the principal purposes of the park to preserve and interpret the Kalaupapa settlement for the education and inspiration of present and future generations to provide a well-maintained community in which the Kalaupapa Hansen's Disease patients are guaranteed that they may remain at Kalaupapa as long as they wish; to protect the current lifestyle of these patients and their individual privacy; to research, preserve, and maintain the present character of the community; to research, preserve, and maintain important historic structures, traditional Hawaiian sites, cultural values, and natural features; and to provide for limited visitation by the general public; and to provide that the preservation and interpretation of the settlement be managed and performed by patients and native Hawaiians to the extent practical, and that training opportunities be provided such persons in management and interpretation of the settlement's cultural, historical, educational, and scenic resources. The park mandate also applies to managing natural resources.

Park management documents (General Management Plan, Resource Management Plan, etc.) are available on-line at the NPS intranet site ([http://www1.nrintra.nps.gov/im/units/pacn/parks/mgmt\\_docs.htm](http://www1.nrintra.nps.gov/im/units/pacn/parks/mgmt_docs.htm)). This website is available only from NPS computer networks. Inquiries about public access should be directed to the park.

Degradation of native vegetation by feral ungulates requires specific management attention. Some fencing was installed and ungulate removal from some areas in the Puu Alii plateau wet forest and remnant native areas on the Kalaupapa peninsula has been done. Following ungulate removal restoration of vegetation and weed control, monitoring of invertebrate pollinators and pests on out planted seedlings, and stabilization of existing rare plant populations need to be addressed. Coastal *Pritchardia* forest and strand communities are in the process of being restored to a native state. Recommendations for species re-introduction or augmentation have been made for Kauhako Crater, a which was recently fenced in preparation for a restoration effort. Other issues include: maintenance of water quality and aquatic species diversity in streams, Kauhako Crater lake, and near-shore marine waters, protection of monk seal and sea turtle habitat, and keeping offshore islets free of invasive species.

## INVENTORIES

### **Existing Inventories in Park**

**Vegetation:** Kepler and Kepler (1981) recorded 167 vascular plant species during the Hawaii forest bird survey. A botanical survey of Kauhako crater was completed by Linney in 1987. Medeiros et al. (1996) inventoried the crater plants as part of a Resource and threat monitoring project. PCSU technical report 110 details this inventory. <http://www.botany.hawaii.edu/faculty/duffy/TECHR/PDF/110.pdf>.

An inventory of Puu 'Alii was conducted as part of the 1988 NAR survey. Jacobi (1989) created vegetation maps of the upland plant communities of Molokai including Puu Alii NAR. These were published in PCSU Technical report 68 <http://www.botany.hawaii.edu/faculty/duffy/TECHR/PDF/68.pdf>.

Asherman et al. (1990) did a botanical reconnaissance of KALA and described both the native and exotic vegetation. Canfield 1990 published PCSU technical report 71 which detailed the plants of the north east coastal spray zone. The report is available online at <http://www.botany.hawaii.edu/faculty/duffy/TECHR/PDF/71.pdf>.

Plants of Okala Islet were recently inventoried. Botanical inventories of the cliffs surrounding KALA are currently underway.

**Vertebrate:** Puu Alii was part of the Forest Bird Survey study area, last surveyed in 2004. Shoreline seabird surveys were also conducted in 2001 (Hodges) and 2003 to identify species of resident and migratory seabirds.

Duvall (2000) inventoried reptiles on two of the offshore islets. A moth skink and mourning gecko were collected on Huelo islet.

***Invertebrate:*** A report on the Aquatic insect fauna of Waikolu stream was done by Dan Polhemus in 1992. Aquatic fauna was inventoried by Brasher(1997) and detailed in PCSU technical report 116.  
<http://www.botany.hawaii.edu/faculty/duffy/TECHR/PDF/116.pdf>

***Native Freshwater Communities:*** The aquatic fauna of Kauhako Crater was surveyed in 1999 along with water quality and bacterial sampling. Waikolu Stream was surveyed for macrofauna and aquatic insects. Other streams in the park have not been inventoried.

### **Priorities for New Inventories in Park**

***Vegetation:*** Vegetation mapping at a scale that shows native vegetation fragments and patch size is also needed, especially for Waikolu valley.

***Vertebrate:*** Complete herpetological inventories for KALA are lacking.

***Invertebrate:*** Invertebrate surveys are needed for all areas of native vegetation, especially coastal strand and wet forest sites that may have rare species and/or high diversity.

***Native Freshwater Communities:*** Inventories of intermittent streams on the peninsula are lacking. Baseline macrofauna and invertebrate surveys, particularly for insects, are needed for all streams. The Kauhako Crater lake should be intensively surveyed, with an emphasis on unique invertebrates.

***Native Marine Communities:*** Inventories of marine invertebrates and vertebrates are needed.

### **Buffer Zone Inventories**

***Vegetation:*** Inventories of plants at Kamakou preserve are desired as an addition to vegetation mapping of the Island.

***Vertebrates:*** Forest bird surveys have been conducted at Kamakou preserve and Molokai Forest reserve. Hawaiian Monk seal inventories are being conducted on the leeward shores of Molokai Island.

***Freshwater Marine:*** Pelekunu stream in Pelekunu Preserve was inventoried for aquatic vertebrates and invertebrates. All five species of native gobies (oopu) were observed.

### **Existing Monitoring in Park**

***Vegetation:*** Removal of Java plum (*Syzygium cumini*) in preparation for restoration, and monitoring to determine control Java plum efficacy, is underway. Monitoring programs

have been designed and implemented for the threatened *Tetramolopium rockii* var. *rockii* and the endangered *Centaurium sebaeoides*. A monitoring program will track survivorship, threats, and pollination success of the endangered *Brighamia rockii* and *Scaevola coriacea* on offshore islets. Rare plants of Kauhako Crater have been tagged, measured, and evaluated. As part of the Resource and threat monitoring plan for Kauhako crater (Medeiros et al. 1996). These protocols were published in a technical report available online at <http://www.botany.hawaii.edu/faculty/duffy/TECHR/PDF/110.pdf>.

Ongoing projects include restoration of coastal *Pritchardia* forest, lowland dry/mesic forest, and coastal strand vegetation, ungulate removal from a section of Puu Alii plateau.

**Vertebrate:** An avian disease survey was conducted at Kalaupapa NHP and the surrounding Pelekunu preserve, Kamakou Preserve and Puu Alii Natural Area Reserve during 2003.

Ungulate monitoring has occurred on transects within Waikolu Valley.

Data was collected on avian malaria, avian pox, and the distribution and breeding habitats of the southern house mosquito *Culex quinquefasciatus*.

A study of the movements of axis deer on the Kalaupapa Peninsula was conducted to understand the life histories of Axis deer. (Goltz et al. 2001)

Monitoring of resident monk seal beach and shoreline use is currently occurring in the park.

**Invertebrate:** Protocols for monitoring hihiwai (*Neritina granosa*) snails in streams have been established. As part of avian disease study, short-term monitoring of mosquitoes has taken place at Puu Alii.

**Air Quality:** Air quality and fire danger monitoring on the Kalaupapa peninsula occurs as part of the RAWS monitoring network. Temperature, temperature change, RH, wind speed, wind direction, total solar radiation, fuel moisture, and soil moisture are measured.

### **Priorities for New Monitoring in Park**

**Vegetation:** The top priority for future monitoring is vegetation community recovery after ungulate removal. Currently about 30 rare plants and 34 non-rare species (including dominant and keystone species) are being propagated for out-planting. Monitoring the success of out planting includes observing insect pests and pollinator populations on out detailed vegetation mapping planted plants, long-term monitoring of known rare plants, especially in Kauhako Crater.

**Vertebrate:** Forest bird populations on the peninsula and in the valleys as well as breeding populations on of shore islets need to be monitored.

Other monitoring needs include, hihiwai populations in Waikolu stream and more detailed monitoring of the Kauhako Crater lake fauna.

### **Buffer Zone Monitoring**

***Vegetation:*** The Nature Conservancy of Hawaii conducts Semiannual vegetation monitoring in Pelekunu and Kamakou Preserves

***Vertebrate:*** The Nature Conservancy of Hawaii conducts biannual ungulate surveys in Kamakou and Pelekunu preserves. Ungulate transects are monitored in Puu Alii Natural Area Reserve by the state of Hawaii Department of Land and Natural Resources, US fish and wildlife forest bird surveys were recently conducted in Kamakou Preserve, Pelekunu Preserve, Puu Alii, and Molokai Forest Reserve.

***Invertebrate:*** Astelia invertebrate monitoring is conducted by USGS-BRD in Kamakou Preserve.

***Native Freshwater Communities:*** Monitoring of fresh water biota was conducted in Pelekunu stream and detailed in a PCSU Technical report 116.

## **CONCLUSIONS**

While the original intention of Kalaupapa National Historical Park was to ensure the protection of unique cultural resources, the park contains significant natural resources. These include coastal cliffs, offshore islets, coral reef, marine resources, seal hauling beaches, dry land forest, a unique lake, perennial and intermittent streams, and mid elevation rain forest. These resources are threatened by invasive species such as exotic plants and feral ungulates. Measures such as vegetation restoration, fencing, removing ungulates, and exotic plant management are key to preserving the unique and diverse natural resources that KALA encompass.

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